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A HYDROLOGIC ENGINEERING ANALYSIS OF A FAILED RANGELAND WATER CONTROL STRUCTURE ON THE BUENOS AIRES NATIONAL WILDLIFE REFUGE

Cameron Dorsett[1*]; Donald Slack[2]; Mary Nichols[3]; Kamel Didan[4]

[1]University of Arizona, Biosystems Engineering Graduate

ckdorsett@email.arizona.edu - +1 (979)402.4275

[2]University of Arizona, Department of Biosystems Engineering. 1177 E. 4th St, Shantz Bldg., Rm 627. Tucson, AZ, USA 85721
[3]USDA Agricultural Research Service, Southwest Watershed Research Center. 2000 E. Allen Rd. Tucson, AZ 85719
[4]University of Arizona, Department of Biosystems Engineering. 1177 E. 4th St, Shantz Bldg., Rm 403. Tucson, AZ, USA 85721

Abstract

This report summarizes a hydrologic engineering analysis of a failed concrete drop spillway (broad-crested weir) water control structure at the outlet or "pour point" on the Buenos Aires National Wildlife Refuge (BANWR) watershed southwest of Tucson, AZ. The main objective was to determine the maximum flow the structure could pass without failure (discharge capacity) as well as the rainfall recurrence interval and duration which would result in a flood of a magnitude which would exceed the capacity of the spillway and thus likely lead to failure of the structure. The layout, function, and characterization of the watershed was established using modern software programs and available imagery. The discharge capacity of the concrete drop spillway was found to be 21.1 [m^3/s]. After evaluating results obtained from the Rational Method and the Curve Number (CN) Method (with assumptions of closed upper-watershed gates and stock pond retention having no effect), the spillway capacity was adequate to withhold runoff volumes generated from 10-yr to 25-yr recurrence interval rainfalls of variable durations and intensities provided the spatial extent of rainfall was limited to one of the two small sub-watersheds (Sub-watersheds A and B). However, if rainfall occurred over the entire watershed or Sub-watershed C then the spillway capacity was exceeded by runoff volumes generated for 10-yr and 25-yr recurrence interval rainfalls of all durations as well as all generated design storms of greater magnitude and intensity.

Keywords: hydraulic structures, design capacity, hydrologic analysis, runoff, curve number.